

Accuracy Characteristics for ZMP Risk Reduction Conflict Scenario, Hours 1950-2210

1 Introduction

This document contains an abridged version on the scenario characteristics for hours 1950 to 2210 (actual recorded data from 19:50.01 to 22:10.01) GMT recorded on October 16, 2002 at Minneapolis ARTCC (ZMP).

Characteristics provided are general statistics determined from the scenario on general air traffic activity and aircraft and air carrier characteristics. Definitions for these scenario characteristics are provided in [1]. Definitions for the conflict and encounters in Tables 1 and 2 are further explained in [2] and [3].

2 Conflict and Encounter Properties

Table 1: Conflict Parameter Distributions

			Non Time-Shifted	Time Shifted ¹	
		Required Sample Size (2x)	Reference ² (x)	Conflict Analysis 1	Conflict Analysis 2
Number of Conflicts		137	68	136	104
Horizontal Separation	0 to 1 nm	25 18.25%	12 17.65%	24 17.65%	18 17.31%
		37 27.01%	19 27.94%	36 26.47%	27 25.96%
	2 to 3 nm	25 18.25%	12 17.65%	25 18.38%	20 19.23%
		29 21.17%	15 22.06%	31 22.79%	23 22.12%
	4 to 5 nm	21 15.33%	10 14.71%	20 14.71%	16 15.38%
Vertical Separation	0 to 400 ft	129 94.16%	64 94.12%	125 91.91%	95 91.35%
		4 2.92%	2 2.94%	5 3.68%	5 4.81%
	800 to 1200 ft	0 0.00%	0 0.00%	1 0.74%	0 0.00%
		4 2.92%	2 2.94%	4 2.94%	3 2.88%
	1600 to 2000 ft	0 0.00%	0 0.00%	1 0.74%	1 0.96%
Encounter Angle	0° to 30°	71 51.82%	35 51.47%	80 58.82%	67 64.42%
		17 12.41%	8 11.76%	18 13.24%	12 11.54%
	60° to 90°	8 5.84%	4 5.88%	8 5.88%	6 5.77%
		0 0.00%	0 0.00%	1 0.74%	1 0.96%
	120° to 150°	4 2.92%	2 2.94%	5 3.68%	4 3.85%
		37 27.01%	19 27.94%	24 17.65%	14 13.46%
Phase of Flight	Level-Level	29 21.17%	15 22.06%	24 17.65%	20 19.23%
		62 45.26%	30 44.12%	56 41.18%	39 37.50%
	Trans-Trans	46 33.58%	23 33.82%	56 41.18%	45 43.27%

¹ Conflict Analysis 1 includes analysis on the Conflict Scenario evaluated based on aircraft tracks starting at the inbound handoff and ending at center crossing boundary (same as Reference Scenario). Conflict Analysis 2 includes the same Conflict Scenario evaluated based on aircraft tracks starting at the first HCS recorded track report and ending at outbound handoff (this is same rules used in URET CCLD Formal Accuracy Test).

² Reference Scenario counts are scaled to account for different aircraft quantity in analysis scenarios.

Table 2: Encounter Parameter Distributions

		Non Time-Shifted	Time Shifted ³	
		Reference ⁴	Encounter Analysis 1	Encounter Analysis 2
	Number of Encounters	1867	1538	1301
Horizontal Separation	0 to 5 nm	322 17.25%	337 21.91%	280 21.52%
	5 to 10 nm	305 16.34%	246 15.99%	215 16.53%
	10 to 15 nm	326 17.46%	266 17.30%	219 16.83%
	15 to 20 nm	446 23.89%	316 20.55%	259 19.91%
	20 to 25 nm	467 25.01%	373 24.25%	328 25.21%
Vertical Separation	0 to 1000 ft	739 39.58%	554 36.02%	465 35.74%
	1000 to 2000 ft	123 6.59%	157 10.21%	130 9.99%
	2000 to 3000 ft	700 37.49%	604 39.27%	504 38.74%
	3000 to 4000 ft	85 4.55%	57 3.71%	51 3.92%
	4000 to 5000 ft	220 11.78%	166 10.79%	151 11.61%
Encounter Angle	0° to 30°	486 26.03%	331 21.52%	317 24.37%
	30° to 60°	139 7.45%	143 9.30%	125 9.61%
	60° to 90°	118 6.32%	117 7.61%	112 8.61%
	90° to 120°	108 5.78%	113 7.35%	89 6.84%
	120° to 150°	222 11.89%	211 13.72%	161 12.38%
	150° to 180°	793 42.47%	623 40.51%	497 38.20%
Phase of Flight	Level-Level	930 49.81%	737 47.92%	635 48.81%
	Level-Trans	548 29.35%	427 27.76%	344 26.44%
	Trans-Trans	388 20.78%	374 24.32%	322 24.75%

³ Same as footnote 1 for encounter analysis. Note: time shifting methodology targeted generation of twice the Reference Scenario's conflict distribution, but the distribution of encounters are achieved only as a consequence.

⁴ Same as footnote 2, counts are scaled to account for different aircraft quantity in analysis runs.

3 Air Traffic Distributions

This section provides metrics that characterize the air traffic. The metrics are flight density partitioned by standard flight levels, flight type and sector penetration, statistics on the number of active flights, ground speed statistics, counts of interim altitude and amendment messages, and air traffic maneuvers by altitude and phase of flight. This section corresponds to Section 3.3 of Reference [1].

3.1 Active Flights

This section corresponds to section 3.3.2 of Reference [1].

Table 1: Statistics on Active Flights per Minute Increment

Count Average	Standard Deviation	Maximum Count	Minimum Count
192.993	94.419	290	0

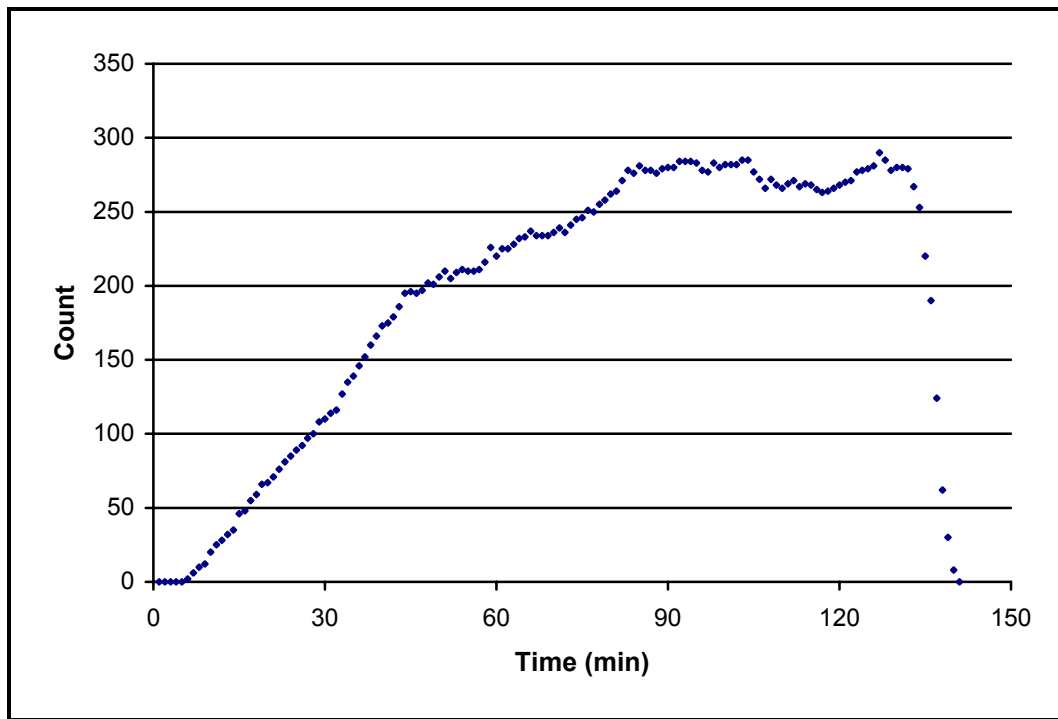


Figure 1: Count of Active Flights per Minute Increment

3.2 Flight Type and Sector Penetration

This section corresponds to Section 3.3.3 of Reference [1].

Table 2: Statistics on Sector Time, Center Time and Sector Penetration by Flight Type

Metric	Arrivals	Departures	Internals	Overflights	All Flights
Average Number of Sectors Penetrated	2.172	2.048	1.888	2.195	2.090
Average Time in Center (sec)	1650.104	1243.478	1405.149	1906.186	1574.181
Average Time in Sector (sec)	753.477	596.934	738.063	862.587	745.957
Percentage by Flight Type	24.774	26.710	17.290	30.452	100.000

3.3 Interim Altitude Messages

This section corresponds to Section 3.3.6 of Reference [1].

Table 3: Statistics on Interim Altitude Messages ⁵

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
474	2.479	0.781	6	1

3.4 Amendment Messages

This section corresponds to Section 3.3.7 of Reference [1]

Table 4: Statistics on Amendment Messages per Flight⁶

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
311	2.138	1.338	9	1

⁵ Statistics on flights with interim altitude messages only

⁶ Statistics on flights with flight plan amendments only

3.5 Air Traffic Maneuvers

This section corresponds to Section 3.3.8 of Reference [1]. Detailed statistics on air traffic maneuvers are provided in Appendix C.

Table 5: Total Track Report Maneuver Count by Vertical and Horizontal Phase of Flight

Vertical Phase	Horizontal Phase of Flight		Total
	STR	TURN	
ASC	4874	1133	6007
DES	4523	967	5490
LEV	1648	1003	2651
Total	11045	3103	14148

Table 6: Percent breakdown of Flight Tracks by Vertical and Horizontal Phase

Vertical Phase	Horizontal Phase of Flight		Margin (%)
	STR (%)	TURN (%)	
ASC	34.450	8.008	42.458
DES	31.969	6.835	38.804
LEV	11.648	7.089	18.738
Margin (%)	78.068	21.932	100.000

4 Aircraft Distributions

This sections provides the metrics used to characterize the aircraft provided in the scenario. The selected metrics are aircraft type, model, navigational equipment, and the air carriers operating in the airspace. The section corresponds to Section 3.4 of Reference [1].

4.1 Aircraft Type

This section corresponds to Section 3.4.1 of Reference [1].

Table 7: Count by Aircraft Type

Aircraft Type	Count	Percentage of Total
J	459	59.226
P	102	13.161
T	130	16.774
Unknown	84	10.839
Total	775	100.000

4.2 Aircraft Models

This section corresponds to Section 3.4.2 of Reference[1].

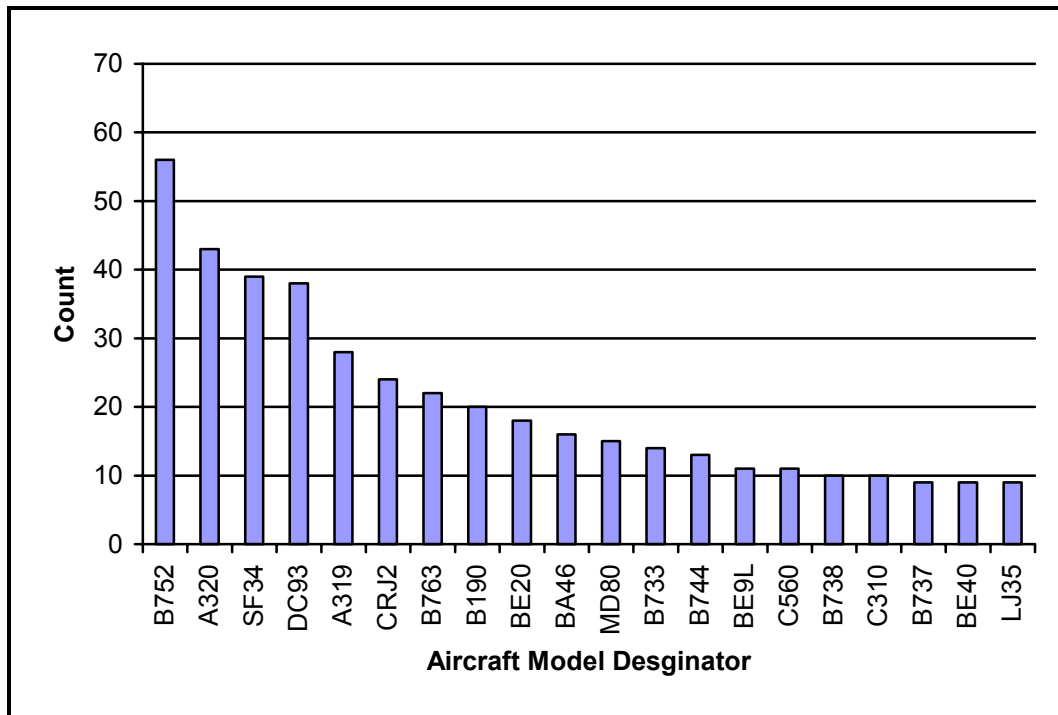


Figure 2: Count of Top Twenty Aircraft Models

4.3 Navigational Equipage

This section corresponds to Section 3.4.3 of Reference [1].

Table 8: Count by Aircraft Navigational Equipage Type

Nav. Equip. Designator	Count	Percentage of total
G	200	25.806
E	173	22.323
A	151	19.484
I	91	11.742
F	61	7.871
R	39	5.032
W	34	4.387
Q	15	1.935
Unknown	10	1.290
B	1	0.129
Total	775	100.000

4.4 Carrier Distribution

This section corresponds to Section 3.4.4 of Reference [1].

Table 9: Count by Carrier Type

Category	Count	Percentage of Total
Commercial	488	62.968
General Aviation	241	31.097
Other ⁷	46	5.935
Total	775	100.000

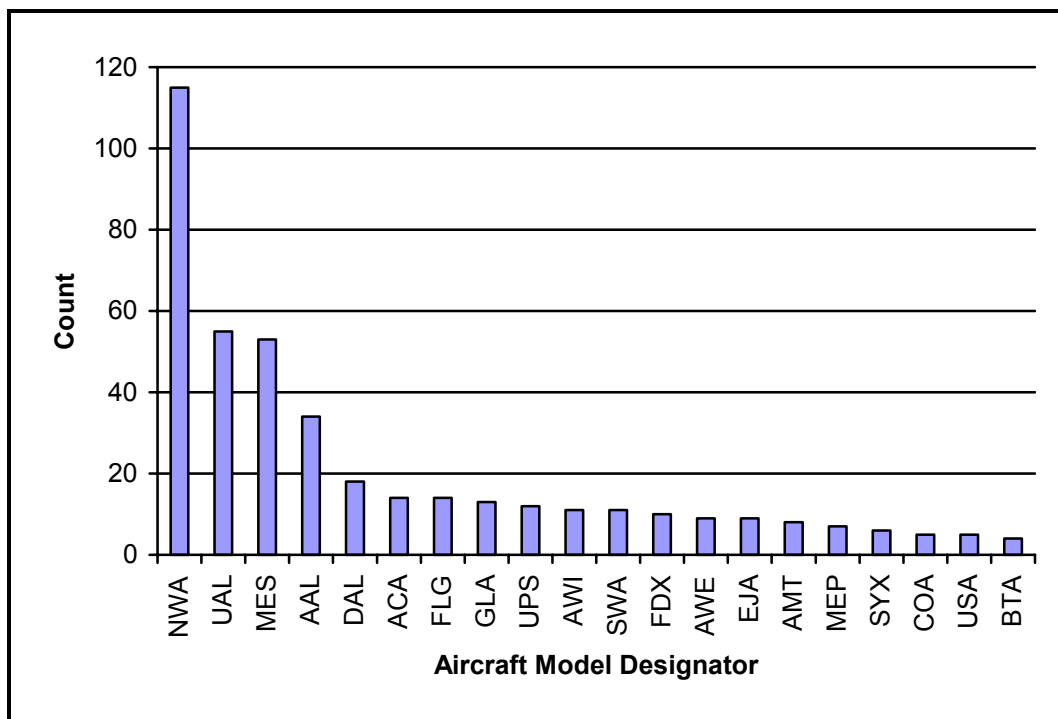


Figure 3: Count by Top Twenty Air Carriers

⁷ Includes military and aircraft with unrecognized designators

5 Reference

- [1] Paglione, M., Oaks, R., Ryan, Dr. H., Summerill, J.S., (Final, January 2000), "Description of Accuracy Scenarios for the Acceptance Testing of the User Request Evaluation Tool (URET) / Core Capability Limited Deployment (CCLD)," FAA William J. Hughes Technical Center / ACT-250, Atlantic City, New Jersey.
- [2] Paglione, Mike M., Oaks, Robert D., Summerill, J. Scott, "Time Shifting Air Traffic Data for Quantitative Evaluation of a Conflict Probe," Submitted to the *American Institute of Aeronautics and Astronautics (AIAA) Guidance, Navigation, and Control Conference*, Austin TX, August 2003.
- [3] Paglione, Mike M., Oaks, Robert D., Bilimoria, Karl D., "Methodology for Generating Conflict Scenarios by Time Shifting Recorded Traffic Data," Submitted to 5th *USA/EUOPR Air Traffic Management R&D Seminar*, Budapest, Hungary, June 2003.